

U.S. Patent Application Serial No. **09/664,332**
Amendment dated October 22, 2003
Reply to OA of **July 24, 2003**

REMARKS

Claims 1-3, 6-10, 12, 17-19 and 21-28 are pending in this application, with claims 9, 17-19, 21 and 23-26 currently withdrawn from consideration. Amendments to claims 1, 8 and 26 are proposed herein. Applicants submit that no new matter is added by these amendments.

The proposed amendment to claim 1 inserts the phrase --by chain reaction-- after “to cure” in line 3. This amendment is discussed below.

The amendments to claims 8 and 26 are made to correct spelling errors in the claims.

Claims 1-3, 6-8, 10, 12, 22, 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hamazu et al. (U.S. Patent No. 5,359,017), Buchwalter et al. (U.S. Patent No. 5,879,859), Starkey (U.S. Patent No. 5,384,339) and Green ‘592 (U.S. Patent No. 4,252,592) in view of Green et al. ‘938 (U.S. Patent No. 4,299,938).

Reconsideration of the rejection is respectfully requested in view of the amendment to claim 1.

First of all, Applicants note that in the previous amendment, the proportion of curing agent component was amended to be 0.3 to 1.4 mol per mol of photopolymerizable resin. Applicants argued that Starkey teaches away from this limitation. In the final Office action, the Examiner discusses Starkey’s disclosure of up to 10 parts by weight of a thermohardening catalyst per 100 parts of the resin component. The Examiner notes that if the curing agent were maleic anhydride and the resin were 3,4-epoxycyclohexylmethyl-3-4-epoxycyclohexane carboxylate, the molar ratio would

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be 0.32:1, still within the claimed range.

However, Applicants note that this argument requires the particular selection of maleic anhydride, which has a low molecular weight, as the catalyst, and the selection of 3,4-epoxycyclohexylmethyl-3-4-epoxycyclohexane carboxylate, which has a high molecular weight, as the resin, in order to just meet the claim limitation. Applicants submit that there is no specific suggestion in Starkey for this combination.

In particular, Applicants note that maleic anhydride is listed only as one of a very long list of thermohardening catalysts in column 20, line 10, to column 21, line 11, and does not appear in any of the Examples in Starkey. That is, the Examiner has picked one combination of catalyst and resin from the vast number of possible permutations of the listed catalysts and resins, this combination being **against the general teaching of the reference** and being perhaps the only permutation meeting the limitation of 0.3 to 1.4 mol per mol. Applicants respectfully submit that this is improper picking and choosing from the reference.

In addition, the Examiner states that 3,4-epoxycyclohexylmethyl-3-4-epoxycyclohexane carboxylate is used in Examples 2 and 5 of Starkey. However, Example 2 appears to use hexadecane resins UVR6105 and UVR6212. Example 5 refers to cycloaliphatic epoxy resin UVR6110. Neither of these Examples appears to use any anhydride.

Therefore, Applicants submit that their previous argument, that Starkey teaches away from the "0.3 to 1.4" limitation of the present claims, is valid, and that a *prima facie* case of obviousness cannot be made using the cited references.

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Moreover, Applicants have herein proposed amending claim 1 to limit the curing mechanism by a specific photopolymerization initiator component of the present invention to curing “by chain reaction” to distinguish the invention from conventional photo curing and heat curing. This emphasizes the point that the photopolymerization initiator component for the present invention defined by the structural formula (IV), (IV') or (V) has been limited to a compound that makes it possible to cure by chain reaction. The most remarkable difference between chain curing and photo curing and heat curing is that, once the chain curing begins, curing proceeds as if continuously propagated by the heat generated from to its own curing reaction heat, even after provision of energy is stopped, whereas photo curing and heat curing require continuous provision of energy to complete the curing. Applicants argue that chain curing is different from conventional photo curing and heat curing, and that it is industrially useful. Applicants here compare the claim as amended with the cited references.

In the composition comprising only the specific sulfonium salt of the structural formula (IV), (IV') or (V), chain curing does not occur. In order to generate chain curing, co-existence of both the specific sulfonium salt and an acidic anhydride is important.

In a system wherein an acidic anhydride is added to a general sulfonium salt other than the specific sulfonium salts of the structural formula (IV), (IV') and (V), chain curing does not occur. Applicants have demonstrated this fact in the test results of the Declaration by Noriya Hayashi under 37 CFR 1.132, submitted on March 3, 2003.

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In the system expected from Starkey '339 and the other references in which an acid anhydride is added to a photopolymerization initiator, the function of a photo curing reaction may be enhanced in the system wherein an acid anhydride is added to a photopolymerization initiator, but chain curing does not develop in this system. This case corresponds to the Added Comparative Examples 1 and 2 in the test results of the Declaration by Noriya Hayashi. The systems wherein the specific sulfonium salts for the present invention are used are shown in the Added Examples 1-3. The only difference between them is that the Added Examples 1-3 use **specific sulfonium salts** whereas the Added Comparative Examples 1 and 2 use **general sulfonium salts not including the specific sulfonium salts**, and the other components and proportions are similar.

Therefore, the effect of the composition comprising the specific sulfonium salt of the structural formula (IV), (IV') or (V), i.e., the effect of generation of chain curing, which cannot be expected at all from the disclosure of Starkey '339, is made clear.

Green '592 discloses a system comprising a photopolymerization initiator and a polymeric acid anhydride, and the technical feature of which is similar to that of the above-mentioned Starkey '339 patent.

The content of Green '938 relates to a system comprising a sulfonium salt initiator and a resin component. Therefore, even if an acid anhydride is added thereto in view of the other references, the obtained system does not exceed the range disclosed by the above-mentioned Starkey '339 patent.

Since each of the compositions disclosed in the above-mentioned references comprises an acid anhydride, it is expected that the curing reaction by solely heating would proceed by positive

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heating. However, in order to promote the curing reaction, a step of heating is essential. Therefore, the curing is essentially different from the chain curing for the present invention in which curing is carried out without going through a step of heating.

Hamazu et al. '017 relates to a preserving and stabilizing agent for a photo curing resin, which has a similar structure to a polymerization initiator. However, the effect of the agent is completely different, and therefore Hamazu et al. '017 merely discloses an invention for suppressing polymerization reaction. Therefore, when the agent from Hamazu et al. '017 is added, the activity of the polymerization initiator is suppressed, which leads to suppression of the reaction. Even if an acid anhydride were introduced to this stabilizing agent, no effect would be expected. On the contrary, if a large amount of the stabilizing agent was added, the reaction would be inhibited. Of course, chain curing does not occur.

Finally, regarding the difference from Buchwalter et al. '859, the content disclosed in Buchwalter et al. '859 is similar to that discloses in the References mentioned above. That is, the components of Buchwalter et al. '859 are an epoxy, an acid anhydride (hydrogenated phthalic anhydride is used in the Examples) and a photopolymerization initiator (a sulfonium salt is used in Examples, but the amount to be added is not less than 5-fold of the conventional amount, which is not less than twice of the maximum amount defined by the claims of the present invention).

However, similar to the references mentioned above, chain curing does not occur by using these components as a matter of course. In order to generate chain curing, the specific sulfonium salt of the structure formula (IV), (IV') or (V) should be used. Furthermore, as is apparent from the Examples, the features and purpose of Buchwalter et al. '859 are completely different from those of

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the present invention. Hereinafter these differences are shown based on the Examples of Buchwalter et al. '859.

In the Examples, an epoxy and an acid anhydride are used in the weight ratio of 2:1, and a sulfonium acid photopolymerization initiator (UVI-6974) is added thereto by the amount of 16wt% or more relative to the total amount. Thereafter a small amount of additive, etc., are added. The composition thereof is indeed quite similar to the test results of the Declaration by Noriya Hayashi. Although the kind of epoxy and acid anhydride, etc., are slightly different from those of the Added Comparative Examples (in addition, the amount to be added of the acid anhydride of the reference is larger than that of the Added Comparative Examples), the Added Comparative Examples use UVI-6974, which is similar to that for the reference, as a photopolymerization initiator. Therefore, it is demonstrated that Buchwalter et al. '859 does not develop chain curing.

Furthermore, in the Examples Buchwalter et al. '859, a composition as mentioned above is prepared, spread by spin-coating and heated once at 130°C to give a film (wherein the film is partially cured but not cured completely). The portions except for the portions exposed to light are removed by masking the film, irradiating UV with the masked film and washing the film with a solvent. Since the removal by a solvent can be readily carried out in this method, it is unlikely that the film is completely cured. That is, the composition as disclosed in Buchwalter et al. '859 is one kind of, so-called photosensitive materials and resist materials.

On the other hand, the composition of the present invention is not used for such photosensitive materials nor for resist materials. When the steps similar to those of the Examples of Buchwalter et al. '859 are carried out using the chain curable resin composition used in the present

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invention, curing is instantly completed at the initial heating to 130°C, and removal by a solvent, which follows after the additional UV irradiation, cannot be carried out. This is because since the specific sulfonium salt of the structural formula (IV), (IV') or (V) capable of chain curing, which is the feature of the present invention, is used, chain curing initiates immediately after the generation of chain curing and the whole system is completely cured. Conversely, chain curing is instantly complete by using the combination of the specific sulfonium salt of the structural formula (IV), (IV') or (V) and an acid anhydride of the present invention, whereas chain curing does not occur in the Examples of Buchwalter et al. '859. Buchwalter et al. '859 does not expect at all the specific combination of compounds being capable of chain curing. On the other hand, if chain curing occurs, the object of the invention disclosed in Buchwalter et al. '859 cannot be achieved.

Applicant submit that the Examples of Buchwalter et al. '859 are similar to those of the Comparative Examples of the present invention.

Applicants therefore submit that the present invention is clearly distinguished from the cited references, and that claims 1-3, 6-8, 10, 12, 22, 27 and 28 are novel and non-obvious over the references, taken separately or in combination. Reconsideration and withdrawal of the rejection are respectfully requested.

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If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact Applicant's undersigned agent at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, Applicant respectfully petitions for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

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